those techniques will help the coordination of LEO MSS < 1 GHz services throughout the world.

c. Requirement for additional spectrum. Document 8-3/18 was approved which identified the need for seven MHz of primary allocation by year 2005, and 13 MHz by year 2010 due to projected subscriber demands.

d. Resolution 46. Although a paper was prepared on this issue in Toronto, it is dealt with as separate subject elsewhere in this paper. Support for improvements to Resolution 46 was shown by ITU-R Study Group 8/3.

6.2 CEPT

CEPT views, as a separate body, are unknown regarding Little LEO issues. However, several of the CEPT countries individually were in attendance at the ITU-R Study Group 8/3 meeting at Toronto this summer, and those countries were generally very supportive of the issues mentioned in 6.1 above. Belgium has been in contact with the chairman of IWG-2 in order to share views on subjects of common interest with the CEPT administrations at the working level, but no substantive exchanges have taken place to date. It is the understanding of IWG-2 that several of the CEPT countries individually support similar improvements to the ITU footnotes and the allocation of additional spectrum for the LEO MSS < 1 GHz service. CEPT countries which are likely to provide full support for Little LEO initiatives for WRC-95 are Belgium and France. The U.K. is generally supportive of the footnote improvements, but may not feel strongly about the allocation of additional spectrum at WRC-95.

6.3 CITEL

CITEL countries have not developed sufficient knowledge of the Little LEO systems, nor of their operations to have established CITEL positions on the LEO MSS < 1 GHz issues. Individually several of the CITEL countries are supportive, and these generally are the countries which have an interest in obtaining or developing LEO MSS < 1 GHz systems. Known CITEL countries supporting LEO MSS < 1 GHz objectives are Canada, U.S., Mexico, Venezuela, Argentina, and perhaps Brazil and Columbia. As a body, CITEL this summer established a Working Group on Little LEO for the purpose of exchanging information. We can probably expect that CITEL will start growing in awareness on Little LEO issues in the coming years, but is unlikely to be a cohesive force for supporting Little LEO issues for WRC-95.

6.4 CANADA

Canada, as a member of both the ITU-R Study Group 8/3 and CITEL showed strong interest in accomplishing the same initiatives for the LEO MSS < 1 GHz service as the U.S. at the

Toronto meeting this summer. Canada felt strongly that the footnote initiatives outlined above in 6.1 are necessary to the proper coordination and operation of the LEO MSS < 1 GHz service on a world-wide basis. A Canadian chaired one of the major drafting groups at the Toronto meeting and led a strong effort to forward a supportive paper on sharing and changes to the footnotes to the fall ITU-R meeting of SG 8/3.

6.5 OTHER

A number of other countries are supportive of LEO MSS < 1 GHz service objectives in general terms, but have not had an opportunity to develop specific support for Little LEO objectives for WRC-95 outside of ITU-R Study Group 8/3. Countries known to be generally supportive of Little LEO in general are Japan and Australia.

7.0 PROPOSALS FOR NGSO MSS

Agenda 2.1(a) and 3.0(d) provide for the consideration of constraints on existing allocations and the adoption of limited MSS allocations if necessary, below 3 GHz. Industry Advisory Committee Proposals for MSS below 1 GHz for these agenda items are addressed below.

7.1 Allocations

A review of the MSS allocation below 1 GHz indicate areas where several proposals should be made too improve the usefulness of existing allocations for the MSS below 1 GHz. These are described on a band by band basis.

7.1.1 Revisions to Existing Allocations

7.1.1.1 137-138 MHz

MHz
137.175 - 138

Allocation to Services		
Region 1	Region 2	Region 3
137.175 - 137.825	~~SPACE OPERATION (space to Earth) METEOROLOGICAL SATELLITE (space to Earth) SPACE RESEARCH (space to Earth)~~ Mobile Satellite (space-to-Earth) 599B Fixed Mobile except aeronautical mobile (R) 596 597 598 599 599A	

ADD FN XXX: METEOROLOGICAL SATELLITE TO BE CO-PRIMARY UNTIL 1 JANUARY 2006, AND SECONDARY UNTIL 1 JANUARY 2010 TO PROTECT CONTINUING OPERATIONS (U.S. Gov't Suggestion).

7.1.1.2 149.9-150.05 MHz

The land mobile satellite service allocation in this band should be changed to a generic MSS allocation.

MOD

MHz
148 - 150.05

Allocation to Services		
Region 1	Region 2	Region 3
148-149.9 FIXED MOBILE except aeronautical mobile (R) MOBILE-SATELLITE (Earth-to-space) 599B	148-149.9 FIXED MOBILE MOBILE-SATELLITE (Earth-to-space) 599B	
149.9-150.05		RADIONAVIGATION-SATELLITE ~~LAND~~ MOBILE-SATELLITE (Earth-to-space) 599B 609B 608B 609 609A

Reason: The Land Mobile Satellite allocation should be made generic, like the others to allow for maximum flexibility in system implementation.

7.1.1.3 608B/609B

The text in these footnotes should be changed to read as follows:

MOD 608B
WARC-92

The use of the band 149.9-150.05 MHz by the ~~land~~ mobile-satellite service is subject to the application of the coordination and notification procedures set forth in Resolution **46 (WARC-92)**. The ~~land~~ mobile-satellite service shall not constrain the

development and use of the radionavigation-satellite service in the band 149.9-150.05 MHz. ~~Land mobile earth stations of the land mobile satellite service shall not produce power flux density in excess of 150 dB(W/m²/4 KHz) outside national boundaries.~~

609B
WARC-92 In the band 149.9-150.05 MHz, the allocation to the ~~land~~ mobile-satellite service shall be on a secondary basis until 1 January 1997.

Reason: The removal of -150 dB(W/m²/4kHz) in FN 608B reflects the fact that there are no fixed or mobile services in this band. The removal of land in both Footnotes reflects the proposal in 7.1.1.2.

7.1.2 ADDITIONAL ALLOCATIONS

The IWG-2 group identified potential frequency bands for additional allocation to the NGSO MSS service in section 4.1. The IWG-2 recommendation for additional spectrum includes only those bands within the "Priority One" category as follows:

7.1.2.1 225-235 MHz

MOD MHz
225.0-235.0 MHz

Allocation to Services		
Region 1	Region 2	Region 3
225-230 BROADCASTING MOBILE SATELLITE (Space-to-Earth) Fixed Mobile 622 628 629 631 632 633 634 635 599A 599B XXX	225-235 FIXED MOBILE MOBILE SATELLITE (Space-to-Earth) 599A 599B XXX	225-230 FIXED MOBILE BROADCASTING AERONAUTICAL RADIONAVIGATION MOBILE SATELLITE (Space-to-Earth) Radiolocation 636 637 599A 599B XXX
230-235 FIXED MOBILE MOBILE SATELLITE (Space-to-Earth) 629 632 633 634 635 638 639 599A 599B XXX		230-235 FIXED MOBILE AERONAUTICAL RADIONAVIGATION MOBILE SATELLITE (Space-to-Earth) 637 599A 599B XXX

ADD FN XXX:

MOBILE SATELLITE (Space-to-Earth) is co-primary in the sub-band 225-235 MHz in Regions 1, 2 and 3. The Mobile Satellite Service shall comply with the provisions of Footnote 599A for operation within this band.

Amend footnotes 599A and 599B to include the band 225-235 MHz

REASON Sharing techniques of LEO-MSS system below 1 GHz have demonstrated the possibility of sharing with these services in these bands.

7.1.2.2 312-315 MHz

MOD MHz
273-322

Allocation to Services		
Region 1	Region 2	Region 3
273-312	FIXED MOBILE 641	
312-315	FIXED MOBILE ~~Mobile Satellite (Earth-to-Space) 641 641A~~ MOBILE SATELLITE (Earth-to-Space) 599A 599B	
315-322	FIXED MOBILE 641	

REASON: Sharing techniques of LEO-MSS system below 1 GHz have demonstrated the possibility of sharing with these services in these bands. This band is already allocated to the MSS on a secondary basis.

7.1.2.3 387-390 MHz

MOD MHz
335.4-399.9

Allocation to Services		
Region 1	Region 2	Region 3
335.4-387	FIXED MOBILE 641	
387-390	FIXED MOBILE ~~Mobile Satellite (space to Earth) 641 641A~~ MOBILE SATELLITE (space-to-Earth) 599A 599B	
390-399.9	FIXED MOBILE 641	

REASON: Sharing techniques of LEO-MSS system below 1 GHz have demonstrated the possibility of sharing with these services in these bands. This band is already allocated to the MSS on a secondary basis.

7.1.2.4 390-399.9 MHz

MOD MHz
335.4-399.9

Allocation to Services		
Regions 1	Region 2	Region 3
390.4-399.9 FIXED MOBILE MOBILE SATELLITE (Earth-to-Space) 641 XXX		

Add FN XXX: The Mobile Satellite service will be limited to Earth-to-space operations in the 390-399.9 MHz portion of this band, and will observe the provisions of footnotes 599B and 608X (as amended to include the additional bands allocated to the Mobile Satellite service).

REASON: Sharing techniques of LEO-MSS system below 1 GHz have demonstrated the possibility of sharing with these services in these bands.

7.1.2.5 399.9-400.05 MHz

MOD MHz
399.9-400.05

Allocation to Services		
Regions 1	Region 2	Region 3
399.9-400.05 RADIONAVIGATION SATELLITE MOBILE SATELLITE (Earth-to-space) 609 645B 599B 608Y		

Add FN XXX: The Mobile Satellite service will be limited to non-voice, non-geostationary satellite systems in the in the 390-399.9 MHz portion of this band. Footnotes 599B and 608X (as amended to include the additional bands allocated to the Mobile Satellite service) apply to the operation of the NGSO MSS services in this band.

Note: Footnotes 599B, 608Y must be amended to include the 399.9-400.05 MHz band.

REASON: The transit system is being phased out of this band making it available for an MSS allocation.

7.1.2.6 138-144 MHz

MOD MHz

138-144

Allocation to Services		
Regions 1	Region 2	Region 3
138-143.6 AERONAUTICAL MOBILE (OR) MOBILE SATELLITE (138-141 S-E) (141-144 E-S) 600 601 602 604 599A 599B 608X	138-143.6 FIXED MOBILE /RADIOLOCATION/ Space Research (Space-to-Earth) MOBILE SATELLITE (138-141 S-E) (141-144 E-S) 599A 599B 608X	138-143.6 FIXED MOBILE Space Research (Space-to-Earth) MOBILE SATELLITE (138-141 S-E) (141-144 E-S) 599 603 599A 599B 608X
143.6-143.65 AERONAUTICAL MOBILE (OR) SPACE RESEARCH (Space-to-Earth) MOBILE SATELLITE (138-141 S-E) (141-144 E-S) 601 602 604 599A 599B 608X	143.6-143.65 FIXED MOBILE SPACE RESEARCH (Space-to-Earth) /RADIOLOCATION/ MOBILE SATELLITE (138-141 S-E) (141-144 E-S) 599A 599B 608X	143.6-143.65 FIXED MOBILE SPACE RESEARCH (Space-to-Earth) MOBILE SATELLITE (138-141 S-E) (141-144 E-S) 599 603 599A 599B 608X
143.64-144 AERONAUTICAL MOBILE (OR) MOBILE SATELLITE (138-141 S-E) (141-144 E-S) 600 601 602 604 599A 599B 608X	143.64-144 FIXED MOBILE /RADIOLOCATION/ Space Research (Space-to-Earth) MOBILE SATELLITE (138-141 S-E) (141-144 E-S) 599A 599B 608X	143.64-144 FIXED MOBILE Space Research (Space-to-Earth) MOBILE SATELLITE (138-141 S-E) (141-144 E-S) 599 603 599A 599B 608X

Note: Footnotes 599A, 599B and 608X must be amended to include the 138-144 MHz band

Reason: Sharing techniques of LEO-MSS system below 1 GHz have demonstrated the possibility of sharing with these services in these bands.

7.2 Sharing Criteria

7.2.1 Existing Allocations

a. Mod RR 608A

Ground based mobile earth stations in the mobile satellite service shall ~~not produce power flux density in excess of -150 dB(W/m²/4KHz)~~ use the coordination distance threshold method in Recommendation (WP 8D)/TEMP/35 Rev.1) to establish necessary separation distances with systems outside national boundaries.

Reason: The -150 dB(W/m²/4KHz) has proven to be operationally unusable. The coordination distance threshold is a more useful approach to coordination across national boundaries. The method is described in Attachment A.

7.3 Resolution 46

Add New Footnote 2, Section 3.1

2. For NGSO MSS systems below 1 GHz the coordination area for land stations is defined according to Rec. (WP 8D/TEMP/46) (See Attachment B.)

Attachment C

IWG-2
LOW EARTH ORBIT MSS BELOW 1 GHz
CANDIDATE BANDS FOR ADDITIONAL ALLOCATIONS[1]

12 December 1994

CANDIDATE FREQUENCY BAND (MHz)	EXISTING ALLOCATIONS AND USE			POTENTIAL LEO MSS ALLOCATION	POTENTIAL SHARING SCENARIOS	COMMENTS/NOTES
	U.S.		INTERNATIONAL			
	NON-GOVERNMENT	GOVERNMENT				
PRIORITY ONE CANDIDATES						
[225-400 MHz] 225.0-235 MHz (Space-to-Earth) and 390-399.9Hz (Earth-to-Space) 312-315 MHz (Earth-to-Space) and 387-390 MHz (Space-to-Earth)	None	Fixed (FN G27 Military Only) Mobile (FN G27 Military Only) Mobile-Satellite (FN G100 235-322 and 335-399.9, Military Only) These bands are heavily used throughout the U.S. for critical military air traffic control and tactical training communications. Specific functions of tactical training include air-ground-air communications for combat weapons training carried out at and in the vicinity of all major air bases and military training areas in the U.S. Tactical and strategic military satellite communications, essential to linking the activities of ground, air, surface, and subsurface mobile platforms, are conducted in this band under G100. Also, rocket test and test data telemetry operations are performed in this band.	312-315 & 387-390 MHz Allocated Secondary to Non-GEO at WARC-92 (FN 641, Art 14) NATO Military Use Differs by Region/Prov. BROADCASTING (African countries only, 223-238 MHz) FIXED MOBILE AERONAUTICAL SPACE OPS. RADIO ASTRONOMY	Uplink and Downlink	CDMA - Low output power spread over multiple MHz in one uplink and one downlink band with 10% + s paration. Non-interference/no protection from existing services - Low PFD in downlink FDMA - Band segmentation - Dynamic channel avoidance	PCC Has Proposed Allocation of 5 MHz at 225-230 MHz and 20 MHz at 380-400 MHz, Dependent on NATO Agreement International: 267-272 MHz Space Ops - Space-to-Earth 272-273 MHz SPACE OPS - Space-to-Earth 380-400 MHz possible TETRA for Europe. CEPT (ERO) planning 216-240 MHz for DAB after year 2005 Mobile Satellite service operating as secondary in 312-315 MHz and 387-390 MHz under Article 14 outside of U.S. (FN 641)
399.9-400.05 MHz (both directions)	RADIONAVIGATION SATELLITE Commercial shipping makes extensive use of TRANSIT-SAT signals for radionavigation.	RADIONAVIGATION SATELLITE TRANSIT-SAT (polar orbiting satellite) downlink transmissions in this band support worldwide navigation which expires 1 January 1997. Government use of the mobile-satellite service is limited by US319 to earth stations operating with nongovernment satellites.	Region - All RADIONAVIGATION -SATELLITE	Uplink or downlink	FDMA and CDMA - Dynamic Channel Avoidance Possible In-Band Feeder Link	Allocated in U.S. as primary uplink in NGSO process beginning 1/1/97; included on WRC-95 preliminary agenda

138-144 MHz (138-141 Space-to-Earth) (141-144 Earth-to-Space)	None	FIXED MOBILE This band is the main frequency band for the Aeronautical Mobile (OR) Service, and any changes to the current use would have to be coordinated among the European countries and the U.S.	Region 1 AERO. MOBILE (OR) SPACE RESEARCH 600, 601, 602, 604 Region 2 FIXED MOBILE /RADIOLOCATION/ SPACE RESEARCH (Space-to-Earth) Region 3 FIXED MOBILE SPACE RESEARCH (Space-to-Earth) 599, 603	Uplink and / or Downlink	FDMA and CDMA - Operation Similar to Existing NGSO Sharing - Dynamic Channel Avoidance - Low Output Power	U.S. footnote G30: Fixed & Mobile "generally" limited to military operations, similar to 148.0-149.9 MHz 599: In Australia, band is allocated to broadcasting until that service can be moved to regional broadcast bands 603: In China, band is allocated to radio-location on primary basis
PRIORITY TWO CANDIDATES						
157.0375-174 MHz	MARITIME MOBILE (part) LAND MOBILE (part) (May be scheduled for narrow-band use only in 1995)	FIXED (part) MOBILE (part)	Region 1 FIXED MOBILE (except aeronautical mobile) Region 2 & 3 FIXED MOBILE	Space-to-ground direction	FDMA sharing similar to 137-138 MHz band: - Band segmentation CDMA sharing: - low pfd at ground	Wide band-width ideal for downlink for FDMA and CDMA systems: - FDMA wide channel selection - CDMA wide bandwidth allows reduced pfd at ground 616: 163-167 is Space Operation Service (S-g) in China (Article 14) 615: 162-174 is broadcasting in Morocco 617: 167-174 is broadcasting in Afghanistan, China, Pakistan 618: 170-174 is broadcasting in Japan
450-460 MHz	LAND MOBILE Space Research and Space Operations (FN664 450 MHz) Remote pickup broadcast 450-451, 455-456) Public safety, industrial, land transportation (451-454, 456-459).	Space Research and Space Operations (FN664 450 MHz) Veteran's medical programs depend upon the use of biomedical telemetry and telecommunications in conjunction with nongovernment medical activities. Some services considered public safety services. This band being considered for rechannelization	Region - All FIXED MOBILE	Uplink and Downlink, including Potential for Feed Links	CDMA - Low Output Power - Low PFD in Downlink - Band Segmentation FDMA - Dynamic channel avoidance	Secondary allocation to Space Research Easy to share with FDMA and CDMA MSS systems Potential TETRA band for Europe

470-512 MHz	BROADCASTING: - Chan. 14 to 20 LAND MOBILE (Public safety, industrial, land transportation, domestic public) Broadcasting plans to give up its analog channels and the change to HDTV may free spectrum	none	Regions 1,2,3 BROADCASTING (8 MHz channels for channels 21-34 Reg 1) Region 2 Fixed & Mobile Region 3 FIXED & MOBILE	Uplink and downlink, feederlinks	Sharing easily accomplished with fixed and mobile systems if reallocation of broadcasting spectrum occurs due to low use of UHF channels Possible long-term NGSO MSS allocation	10 MHz for the NGSO MSS service should be allocated on a world-wide basis
512-806 MHz (less 608-614 MHz)	BROADCASTING RADIO ASTRONOMY (608-614 MHz) Broadcasting plans to give up its analog channels and the change to HDTV may free spectrum	RADIO ASTRONOMY (608-614 MHz)	Region 1 BROADCASTING (Ch 21-34 & 35-69) FIXED Region 2 BROADCASTING RADIO ASTRON. Mobile Satellite (E-S) - 608-614 MHz Region 3 FIXED, MOBILE, BROADCASTING RADIOLOCATION	Uplink and downlink, feederlinks	Sharing easily accomplished with fixed and mobile systems if reallocation of broadcasting spectrum occurs due to low use of UHF channels Possible long-term NGSO MSS allocation	10 MHz for the NGSO MSS service should be allocated on a world-wide basis
LOWEST PRIORITY CANDIDATES						
806-824 MHz	LAND MOBILE Private land mobile (806-824) Domestic public land mobile (824-849, 869-894) Aeronautical public correspondence-airphone(849-851, 894-896) General purpose mobile (901-902)	Some portion of this band is used for high-power U.S. Navy shipborne long-range search radars under footnotes US268 and G2. These radars serve a critical role in defense of the fleet, and are also used while in port.	Region 2 FIXED MOBILE BROADCASTING	Space-to-Earth	FDMA and CDMA - Band Segmentation - Low Output Power	Need to Share With Naval Applications Without Interference Heavy use of SMR in band May be available for NGSO MSS use, but is low priority due to heavy use and high powered systems

896-901 MHz (is portion of 890-902 MHz band)	LAND MOBILE (12.5 KHz channels paired with 935-941 MHz band)	Radiolocation (limited to miliary services)	Region 1 FIXED, MOBILE BROADCASTING Region 2 FIXED, MOBILE Region 3 FIXED, MOBILE BROADCASTING Radiolocation	Earth-to-space (in conjunction with 935-941 MHz band)	FDMA and CDMA sharing with private land mobile in the same bands - Band segmentation - Low output power - Dynamic channel avoidance	Growing use of privase land mobile in the U.S.
932-935 MHz and 941-944 MHz	FIXED This band is paired with the 941-944 MHz band and channelized for point-to-point voice and data services. The 932-932.5 MHz end of the band is used for the single channel response from a remote location for point to multipoint multiple address services.	FIXED The 932-935 MHz and 941-944 MHz bands are shared by government and nongovernment fixed service users. It has recently been allocated for Federal use. Use for low-capacity fixed systems is anticipated. Many Federal agencies expect heavy government and nongovernment use for point-to-point and point-to-multipoint communications. Functions include support for aviation activities, remote meter ready for electric power marketing and light route radio relay. The latter includes recommendation of light route systems from higher bands.	REGION 2 FIXED MOBILE except aeronautical mobile Radiolocation	932-935 Uplink 941-944 Downlink Possible Feeder Links in Uplink	FDMA and CDMA - Dynamic Channel Avoidance - Low Output Power - Low PFD in Uplink - Geographic Separation - Band Segmentation	Fixed Channelization Offers Possible Use of Interstitial Spectrum in Both Directions Wide-band spread-spectrum with attendant low pfd's is practical use low priority for NGSO MSS use due to large number of applicants for use of band (60,000)
935-941 MHz	LAND MOBILE Private land mobile trunked and conventional systems in 12.5 KHz channels paired with 896-901 MHz.	-Radiolocation limited to military services (G2) on a secondary basis to non-government LAND MOBILE operations (G2, US116, US215, US268)	REGION 2 FIXED MOBILE except aeronautical mobile Radiolocation	Uplink	FDMA and CDMA - Dynamic Channel Avoidance - Low Output Power - Low PFD in Uplink - Geographic Separation - Band Segmentation	Fixed channelization offers possible use of interstitial spectrum in both directions Wide-band spread-spectrum with attendant low pfd's is practical use

944-960 MHz	FIXED Auxiliary broadcasting, Domestic public fixed, International fixed public, Private fixed microwave. The 944-952 MHz portion is used primarily for radio broadcast stations studio-to-transmitter links (STLs) and intercity relays. These carry frequency modulated stereophonic audio program material, plus ancillary carriers for remote control of transmitters and Subsidiary Communications Authorization (SCA) channels. The 952-953 MHz portion is used in combination with 928-929 MHz. The 953-960 MHz portion is primarily used for fixed point-to-point communications. The band is segmented as 953.00-956.15 MHz for go and 956.55-959.75 MHz for return operation.	-	Region 1 FIXED MOBILE except aeronautical mobile BROADCASTING 703 Region 2 FIXED Mobile Region 3 FIXED MOBILE BROADCASTING	Uplink and Downlink	FDMA and CDMA - Dynamic Channel Avoidance - Low Output Power - Low PFD in Uplink - Geographic Separation - Band Segmentation	Fixed Channelization Offers Possible Use of Interstitial Spectrum in Both Directions Wide-band spread-spectrum with attendant low pfd's is practical use

addalloc.tbl

[1] *Basic Assumptions for All Candidate Allocation*
- *No Displacement of Existing Services*
- *No Harmful Interference to Existing Services*

FCC INDUSTRY ADVISORY COMMITTEE

FOR THE

ITU 1995 WORLD RADIO COMMUNICATION CONFERENCE

~ ~ ~ ~

INTERIM REPORT

OF

INFORMAL WORKING GROUP 3

~ ~ ~ ~

Warren G. Richards
Chair

Ben C. Fisher
Vice Chair

INFORMAL WORKING GROUP 3 - MOBILE SATELLITE SERVICE ABOVE 1 GHZ
Preliminary Report
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MOBILE SATELLITE SERVICE ABOVE 1 GHz

3.0 Introduction

Interim Working Group 3 was established by the FCC Industry Advisory Committee for the ITU 1995 World Radiocommunication Conference at its organizational meeting on May 31, 1994.

The terms of reference of IWG-3 are to draft and justify, for consideration by the Committee as a whole, recommendations for U.S. proposals and positions related to:

(1) spectrum requirements for the mobile-satellite service between 1-3 GHz;

(2) additional frequency bands that could be allocated to MSS between 1-3 GHz;

(3) technical and operational constraints associated with the presently and potentially allocated frequency bands between 1 and 3 GHz to MSS with a view toward facilitating the use of these bands;

(4) addition(s) to/modification(s) of the relevant Radio Regulations;

(5) resolutions and recommendations of World Administrative Radio Conferences which are relevant to (1), (2) and (3) above.

The recommendations for U.S. proposals are to be supported by text which indicates (a) the amount and basis for determination, of spectrum needed for MSS between 1 and 3 GHz; (b) the placement in the spectrum of additional MSS allocations; (c) the unmet spectrum requirements for MSS service links between 1 and 3 GHz, if any; (d) the appropriate sharing criteria, if sharing with other services is required; (e) the time frame associated with any unmet spectrum requirements and any reaccommodation that may be required of existing services; and (f) any consequential changes needed to the international Radio regulations in order to implement the suggested changes/allocations.

Mr. Warren G. Richards was appointed Chairman of IWG-3; Mr. Ben Fisher was appointed Vice-Chairman and Ms. Cecily C. Holiday was the Designated Federal Officer.

The IWG-3 work program consists of the following items:

Agenda Item 2.1 (a)

Allocated Spectrum. The informal working group is to evaluate technical constraints on spectrum allocated to MSS Between 1-3 Ghz on a primary and secondary basis (specifically 1492-1525 MHz, 1610-1626.5 MHz, 1675-1710 MHz, 1970-2010 MHz, 2160-2200 MHz, 2483.5- 2500 MHz, 2500-2535 MHz, and 2655-2690 MHz) with a view toward enhancing its use for MSS between 1-3 GHz. This should include an analysis of all footnotes, resolutions, recommendations, and provisions of the Radio Regulations applicable to this spectrum.

Technical and Operational Criteria Concerning Existing Services. The informal working group should review any dates associated with certain parts of the radio regulations, coordination triggers, classes of allocation and sharing criteria available within the Radio Regulations, Radiocommunication Bureau's rules of procedure and ITU-R recommendations to determine the adequacy for use with MSS between 1-3 GHz. If necessary, the Committee should develop (provide) any other sharing criteria required to maintain compatible operations between the planned MSS between 1-3 GHz and other radio services operating in the allocated frequency bands.

Agenda Item 3(d)

New Allocations. Estimate additional bandwidth requirements for MSS between 1-3 GHz and identify preferred frequency bands with a view toward obtaining limited primary or secondary allocations in 1995. To this extent, provide analysis of any necessary technical and/or operational criteria for other services in candidate bands. Indicate the projected time frame within which new allocations will be needed and by which existing services can be reaccommodated if necessary.

Agenda Item 5

Regulatory Provisions. In conjunction with IWG-2 (MSS Below 1 GHz), the informal working group should develop the regulatory provisions necessary to coordinate LEO MSS between 1-3 GHz with other LEO MSS systems and with other co-primary services. To this end, it should evaluate Resolution 46 with a view toward defining those changes (if any) that will be beneficial to the development of the LEO MSS between 1-3 GHz industry. This cm was developed as an interim procedure at WARC-92 and may need further refinement based on experience to date.

3.1 Background

The 1995 World Radiocommunication Conference (WRC-95) provides a timely and appropriate opportunity for improvement of existing MSS allocations and adoption of new MSS allocations.

The 1992 World Administrative Radio Conference (WARC-92) was the first conference since 1971 to allocate new spectrum to MSS. These additional allocations, below 1 GHz, in the 1-3 GHz range and at 20/30 GHz, were agreed to only at the end of the conference and required a great deal of compromise. The U.S. was the leading proponent of the new allocations; the CEPT countries were the leading opponents of the new allocations. Included among the compromises were such matters as relatively restrictive power limits on MSS systems that will be required to share certain of the bands with other services, limiting certain allocations to particular regions and countries, and the establishment of implementation dates that are as late as 2005 for MSS operations in certain of the new bands. Several resolutions were adopted that specifically noted the need for further study of the potential for sharing of the bands allocated to MSS.

Since the conclusion of WARC-92, there has been a good deal of further analysis in the ITU-R Study Group process and elsewhere of the utility of the different bands and the potential for sharing the band with other services. Those studies are showing that sharing in certain of the bands may be done with fewer restrictions than agreed to in 1992 and, in other cases, that sharing will be more difficult or impossible. In addition, it has become evident since the conference that demand for the new allocations is substantial and continues to grow as new MSS systems continue to be proposed and planned systems continue to progress in their development.

Recognizing the immediate need to deal with MSS matters, the 1993 World Radiocommunication Conference (WRC-93) agreed to include on the agenda of WRC-95 the improvement of existing MSS allocations and, if necessary, the allocation of new MSS spectrum. Thus, WRC-95 presents an opportunity for the U.S. to continue its leadership role in MSS.

3.2 Spectrum Requirements

3.2.1 Existing MSS Spectrum Requirements

The existing use of MSS allocations in the range 1-3 GHz are required for both GSO and NGSO MSS service links. The GSO systems are located in the bands 1525-1559 MHz, and 1626.5-1660.5 MHz. The principal U.S. operators having systems in these allocations are AMSC and COMSAT Mobile Communications.

The U.S. non-geostationary (NGSO) MSS systems which are expecting licenses are IRIDIUM (Motorola), GLOBALSTAR (Loral\Qualcomm), Ellipsat (MCHI), AMSC, Odyssey (TRW), and Constellation Communications. These systems will operate in the allocations 1610-1626.5 MHz and 2483.5-2500 MHz. Two entities, Personal Communications Satellite Corporation and Celsat, Inc. have applied to construct GSO MSS systems in the 2 GHz MSS allocations.

As indicated in the bar chart provided by ITU-R Task Group 8/3 the allocations indicated above have the greatest current and proposed use, i.e., B8 & B10 for GSO MSS and B9 & B14 for NGSO MSS. The chart shows the worldwide use of these allocations.

Figure 3.2.1 - Existing and Planned MSS Networks

Legend for Frequency Bands:

B7	1492-1525 MHz	B13	2160-2200 MHz
B8	1525-1559 MHz	B14	2483-2500 MHz
B9	1610-1626.5 MHz	B15	2500-2520 MHz
B10	1626.5-1660.5 MHz	B16	2520-2535 MHz
B11	1675-1710 MHz	B17	2655-2670 MHz
B12	1970-2010 MHz	B18	2670-2690 MHz

3.2.2 Future Spectrum Requirements

Resolution 1 of the Agenda for WRC-95 provides, in resolves 3.d), for the consideration of "requirements for the MSS and associated feeder links and, if necessary, adopt in 1995 limited allocations." Because of the recent introduction of MSS, it is essential to provide justification for allocations sought to meet future spectrum needs of MSS above 1 GHz.

MSS demand forecasts, primarily as provided in public domain market studies of MSS and terrestrial mobile services, have been used to establish a benchmark projection for MSS usage in the year 2005. The bases for these projections are also provided. The projected user figures are then translated into Erlang (busy) hour traffic, then into equivalent number of voice channels needed to carry that intensity of traffic; and finally, into the required RF spectrum, using the appropriate transmission/modulation and frequency reuse parameters. A range of projected demand, including low, medium and high estimates, is provided.

3.2.2.1 MSS User Projections

(a) Background

While current usage of MSS is relatively low today, this can be attributed to several factors, including: (1) recent introduction of the service; (2) high cost of user terminals ($4,000 and up); (3) relatively high service charges; and (4) other. The use of voice capable MSS systems above 1 GHz is predicted to grow substantially as first, domestic MSS systems such as AMSC are implemented in the mid-1990s, and satellite/cellular systems are introduced in the late 1990s. These systems will enable the use of small transceivers, e.g. cellular telephones, which will ultimately be priced from $200-$500. In fact, much MSS use will be attributed to the use of terrestrial cellular because many terrestrial systems will utilize MSS to extend coverage. Apart from integrated use with terrestrial cellular, MSS systems will be used in areas where no telecommunications is now available, and to facilitate global roaming by cellular users.

Although some critics of mobile satellite service claim that cellular and PCS build-out over the next 10 years will greatly diminish the demand for MSS, these critics do not take account of the fact that terrestrial technologies will never provide service in more than a small fraction of the geographic area of the earth. For example, it is projected that only

15 percent of the world's land masses will be covered by cellular networks by the year 2010. Thus, large geographic areas of the world will remain unserved by cellular communications and a substantial portion of these areas will remain unserved by any telecommunications infrastructures.

Market and other studies in the public domain have been used to assess projections of MSS demand in the year 2010. These studies project demand growing from a base of 3 to 4 million MSS subscribers in 2002 to 8-13 million by 2005, and 22 to 37 million by 2010.

(b) Basis for MSS Service Projections - Target Markets

Mobile satellite service (MSS) systems have been designed to provide global, ubiquitous telecommunications to anyone at any time, in any location. Services will include mobile voice, fax and data. In regions where cellular systems are prevalent, MSS will provide a "value added" service to cellular networks. In effect, cellular service providers will be able to extend their range of coverage by using MSS when implementation of additional terrestrial cell sites is impractical or prohibitively expensive.

Most MSS systems propose to offer dual-mode, cellular/satellite terminals which will allow the user to operate his or her terminal on either a cellular or satellite frequency. Thus, when the phone will search for the strongest signal before originating a call. When a terrestrial system is in range, the terminal will select that system. When the terrestrial system signal is not detected, or is too weak, the terminal will select a pre-designated satellite system. The benefit of the dual-mode phone is that users will obtain access to both terrestrial mobile as well as satellite mobile service, enabling them to take benefit of the likely lower costs terrestrial service, when available. Users may operate their handsets on the local cellular network, and on other cellular networks available through roaming agreements. The MSS service will be utilized where no cellular coverage is available and where no roaming agreements permit use of an existing cellular system.

Research undertaken by MSS operators, as well as independent analysts, have identified the following three markets for MSS service: (1) cellular fill-in market consisting of those users who require mobile services in rural parts of the developed world and in rural/urban areas of countries where terrestrial cellular coverage may be limited; (2) the international business traveler market consisting of professionals who travel to regions with incompatible or limited cellular or PSTN services; and the semi-fixed user market consisting of users requiring services in urban and rural areas of countries which lack PSTN. MSS will be used as both a complement and a supplement to terrestrial mobile telecommunications services, including cellular and the PSTN. The following provide some of the reasons why MSS will fulfill this complementary role:

(1) cellular coverage - by the year 2000, approximately 55% of the world's population will be covered by terrestrial cellular systems. This leaves almost half of the world's population uncovered. In addition, by the year 2000, only 15% of the world's land masses will be covered by terrestrial cellular systems, thereby leaving 85% of the world's land masses uncovered by terrestrial mobile communications, and, in many cases, any

communications infrastructure. Additional terrestrial cellular coverage is projected to be minimal, beyond these figures, because it will not be economically feasible to place cellular networks in areas of low-population density or where such networks cannot be supported by the local economy.

(2) roaming - although terrestrial cellular providers have increasingly sought to enter into roaming agreements and to reduce the complexity of roaming protocols for cellular subscribers, roaming has remained exceedingly complex and costly. Roamers generally must pay for cellular use by credit card, because subscriber validation is not available in roaming situations. Even though nationwide cellular roaming will become increasingly more available and less complicated, international roaming from one terrestrial network to another is unlikely to be implemented in a user-friendly manner.

(3) pricing - although the price for MSS service may range from 50 cents per minute to $3 per minute, depending on the communications alternatives, which may include hotel surcharges and high international rates, MSS service may be considered price competitive in many situations.

(4) availability of the subscriber - MSS services will allow the subscriber to be reached at any time, in any location, with one number.

(5) ease of operation - a current impediment to the use of telecommunications service may be not only the lack of availability of a local network, but the lack of availability of a terminal, such as a phone set or telephone booth. With a dual-mode MSS handset, the subscriber is always capable of placing a call.

The size of the individual market segments identified (cellular fill-in, international business traveler, and semi-fixed user market) will be dependent on a number of factors including the date of introduction of handheld services, the coverage provided by the systems, ease of use, and terminal and user charges. Some of the MSS systems will focus their business and market strategies towards one or two of these segments.

(c) Traffic Volume

The range in applications complicates the task of projecting the number of minutes per subscriber. In situations where MSS is used primarily for extension of terrestrial cellular systems, the number of minutes per year on the satellite system might be smaller than in the case of the international business traveler, and in the case where MSS service is the primary or only telecommunications service available. Based on the market studies reviewed, a reasonable number of minutes per subscriber, on average, would be in the range of 800-1200 minutes per year.

(d) MSS User Projections

The existing market studies provide a range of user projections for MSS:

MSS Subscriber Projections

Projection (millions)	Date	Study
22	2004	IRD
4.11	2003	PCIA
15.0	2004	LTA
6.0	2004	Peat Marwick

(e) Total Peak Spectrum Requirements for Handheld Non-GSO MSS Spectrum for Personal Communications

Following is the methodology used to calculate the total bandwidth requirements to meet projected MSS needs. To arrive at the bandwidth requirement, the peak traffic stream to be supported by the systems must be estimated. The peak traffic stream will depend on the calling characteristics of users over periods of time, including a day, week, month and a year.

Using the methodology, the following spectrum requirements for MSS, in the year 2005, can be developed for handheld (voice) PC/MSS forecast markets:

Market Estimate	Subscribers Millions	Equivalent Spectrum Requirement (each direction) for Handheld Voice Personal Communications MSS
Low	4.11	19.3 MHz
Low	6.0	28.1 MHz
Medium	15.0	70.2 MHz
High	22.0	103 MHz

Note: these estimates do not include spectrum requirements needed to meet "conventional" GSO MSS needs.

(f) Total "Conventional" GSO MSS Spectrum

Based on inputs to ITU-R Task Group 8/3 made by Inmarsat, first in the Toronto meeting, July, 1994, and more recently in Geneva, the forecasts for so called "conventional" MSS (ie, non-handheld PC/MSS, most likely provided by GSO satellites) have been revised downward, to take account of the likely cross-impact to certain conventional MSS markets (particularly land mobile services) which would likely migrate to handheld Non-GSO systems when these more convenient services are available towards the end of the century.

Thus, to compare these projections to the ITU-R, Joint International Working Party preparing for WARC-92 (JIWP-92), the JIWP-92 forecast the following spectrum requirements for each direction, in the year 2010, including a speculative value for LMSS which may have included considerable overlap between "conventional"-GSO and handheld non-GSO:

Service	Minimum Requirement (MHz)		Likely Req't (MHz	
AMS (R) S	14.5		17.5	
Other AMSS	15.0		18.0	
LMSS		41.3		87.6
MMSS	17.0		40.0	
Distress/Sfty	1.0		1.0	
TOTAL	88.8 MHz		164.1 MHz	

With the cross-impacts for LMSS factored in, the Inmarsat contributions provided a more realistic forecast for Conventional MSS Spectrum Requirements (excluding PC-MSS) served as a correction to the original JIWP Report:

Service	Lower Bound MSS Non-Handheld (MHz)		Realistic MSS Non-Handheld (MHz)	
Aero Total	29.5		35.5	
LMSS		13.8		29.2
Maritime	17.0		40.0	
Distress/Sfty	1.0		1.0	
TOTAL	61.3 MHz		105.7 MHz	

The most recent forecasts for conventional MSS have also been truncated to about the year 2005, due to the uncertainties associated with projecting annual growth rates much beyond a 10-year planning horizon. Using the "Realistic" (higher) forecast, this results in a spectrum requirement of approximately 86 MHz in each direction, for GSO MSS.